CLAIMS

1. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes based on the measurement of the light intensity absorbed by a culture medium at a specific wavelength (measurement of the optical density), comprising:

- making a first light beam of variable intensity and pre-set frequency range to pass through a first test-tube through which the substance to be controlled is running,
- making a second light beam of fixed intensity and the aforementioned pre-set spectrum to pass through a second test-tube containing a control sample of the substance to be controlled,
- continuously comparing the intensity of the first and second beams after passing through the respective test-tubes,
- continuously varying the intensity of the first beam, so that the intensities of the first and second beams will be identical in the aforementioned comparison,
- processing the corresponding electrical signal, which determines the aforementioned continuous variation for the continuous real-time calculation of the biomass concentration or parameter of interest in the first test-tube.

2. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes according to claim 1, wherein said calculation of the biomass concentration or parameter of interest is made based on a calibration pattern which is a model that

correlates the values of the aforementioned electrical signal with the biomass concentration or parameter of interest, the concentration of all of the other by-products of interest being estimated based on this model by means of a suitable observer.

3. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 1, comprising:

- means of pumping and circulating (9) the substance to be controlled from a bioreactor or similar (2) to a first test-tube (3),
- a second test-tube (4) in which a static control sample of the substance (1) to be controlled is placed,
- means of emitting light of a variable intensity (5) and pre-set range of frequencies that are applied to the first test-tube (3),
- means of emitting light of a constant intensity (6) and the same frequency range mentioned in the immediately preceding paragraph, which are applied to the second test-tube (4),
- means of sensing (7) the light which passes through the first test-tube (3),
- means of sensing (8) the light which passes through the second test-tube (4),
- means of comparing (10) the two signals corresponding to the light intensities sensed by the above-mentioned sensing means (7,8),
- means for adjusting (11) the output signal, such that by means of the modification of the power applied to the light-emitting means (5), the difference between the two output signals of the sensing means (7,8) will be nil or, equivalently, that the output signal of the

aforementioned means of comparison (10) will be nil,

- means for varying the power (12) applied to the means of emitting light of variable intensity (5) in terms of the output signal of the means of adjustment (11),

- means for sensing and transmitting (13) the instant value of the signal which is being applied to the means of emitting variable intensity light (5),

- and means for processing (14) the output signals of the aforementioned sensing and transmitting means (13), and for calculating (in terms of the output signal and of a calibration pattern) the parameter of interest of the aforementioned substance (1).

4. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein said light-emitting means (5,6) consist of LED diodes which emit at wavelengths within the visible or infrared spectrum and the light-sensing means (7,8) consist of silicon photodiodes.

5. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes according to claim 3, further comprising means for eliminating any possible cases of interference caused by gas bubbles or other particles.

6. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the

spectrum during the development of biotechnological processes, according to claim 5, wherein said means of eliminating any interference consist of an air valve which is located downstream from the first test-tube (3).

7. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 5, wherein said means of eliminating any possible cases of interference consist of the use of a filtering algorithm which is integrated into the processing means (14).

8. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein said pumping and circulating means (9) consist of a hydraulic pump with the suitable pipage.

9. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein said test-tubes (3,4) are of a sturdy materials with a low light absorption index at the wavelengths emitted by the light-emitting means (5,6).

10. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological

processes, according to claim 3, wherein the two test-tubes (3,4) are located in one same compartment, such that the temperature inside these test-tubes will be the same for the purpose of preventing any drift effects due to temperature changes.

11. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein the means of adjustment (11) consist of an IP adjuster.

12. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein the aforementioned means of processing and calculation (14) are subject to being recalibrated by means of the comparison of the results provided thereby and the occasional analysis of the aforementioned substance (1).

13. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological processes, according to claim 3, wherein the aforementioned means of varying the power (12) consist of a voltage-intensity converter.

14. On-line method and equipment for detecting, determining the evolution and quantifying a microbial mass and other substances that absorb light along the spectrum during the development of biotechnological

processes, according to claim 3, wherein the aforementioned means of processing and calculation (14) functionally include a reading data block (15) followed by the filtering block (16) and an estimating block (17) which calculates the concentration of substances of interest based on a mathematical model and which is connected to a recalibration block (18) and to a results display block (19), it also being possible for an optional control block to be incorporated, affording the possibility of obtaining the instant value of the flow of the substrate to the bioreactor (2), thus optimizing the production of biomass or substance of interest.